

**Kentucky**  
**Agricultural Experiment Station**  
University of Kentucky

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**FEEDING TRIALS WITH LAYING HENS**

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- I. Varying amounts of meat scrap.
  - II. Dull-gray and white, shiny limestone.
  - III. All-mash and grain and mash.
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**BULLETIN NO. 294**

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Lexington, Kentucky

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(173)

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## BULLETIN NO. 294

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### Feeding Trials with Laying Hens

By J. HOLMES MARTIN and W. M. INSKO, JR.

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This series of experiments was conducted: (1) to determine the proper percentage of meat scrap to use in the mash to supplement a skim-milk and grain ration, and the value of granulated buttermilk in the laying ration; (2) to compare common ground limestone and a shiny, white limestone as sources of shell-forming material; (3) to compare all-mash and grain-and-mash rations for laying hens.

#### METHODS USED

Accurate trap-nest records were kept of all hens used in these experiments, with the exception of those in the trial with the two types of limestone (Part II), pen production being kept on these. In the experiments reported in Parts I and III all hens failing to lay ten eggs in some one month were excluded from the final averages, as it was thought that they were incapable of reacting normally in a nutrition trial. Records of all hens dying before the end of ten months of the trial were excluded from the yearly averages, but if they had produced thru February, their production was included in the winter averages. Proper adjustment of feed consumption was made for the hens which died.

Nutritive ratios were computed from the figures for digestible nutrients in Henry and Morrison's "Feeds and Feeding." Kaupp's digestive coefficient for meat scrap was used in computing its digestible nutrients.

The prices of eggs, used in the computation of the returns from these trials, were based on wholesale prices on the Louisville market.

TABLE 1.—PRICES OF EGGS PER DOZEN\*

	Cents		Cents
January .....	39.7	July .....	24.5
February .....	32.5	August .....	24.7
March .....	21.3	September .....	29.0
April .....	23.5	October .....	34.7
May .....	23.8	November .....	42.8
June .....	21.8	December .....	50.1

The prices of feeds used in the computations were based on Louisville wholesale prices on ton lot quantities. The prices are as follows:

TABLE 2.—PRICES OF THE FEEDS USED PER 100 POUNDS†

	Dollars		Dollars
Corn .....	1.61	Granulated Buttermilk .....	10.00
Wheat .....	2.38	Skim-milk .....	0.50
Corn Meal .....	1.85	Ground Limestone .....	0.10
Wheat Bran .....	1.68	Bone Meal .....	3.50
Wheat Middlings .....	1.78	Salt .....	2.00
Meat Scrap .....	3.75		

\*Average Louisville wholesale prices November, 1925, to October, 1928, inclusive.

†Based on Louisville wholesale prices November, 1925, to October, 1928, inclusive.

## Part I

### VARYING PERCENTAGES OF MEAT SCRAP IN THE MASH FOR SUPPLEMENTING MILK.

This experiment was started November 1, 1925, to compare the use of meat scrap in varying amounts in the dry mash to supplement skim-milk, and the use of granulated buttermilk for supplementing grain or grain and mash. The dates of the tests which were conducted for three years are as follows:

Series 1—November 1, 1925 to October 31, 1926.

Series 2—November 1, 1926 to October 31, 1927.

Series 3—November 1, 1927 to October 31, 1928.

*Stock.* In Series 1 and 2, 25 Barred Plymouth Rock pullets were used in each pen. In Series 3, 30 White Leghorns and 10 Barred Plymouth Rock pullets per pen were used. These birds were hatched from the Kentucky Experiment Station flocks. The record of the White Leghorns in Series 3 will be treated separately from that of the Plymouth Rocks.

*Rations.* The grain mixture received by all pens consisted of 70 parts of shelled corn and 30 parts of wheat.

Previous experiments at this Station<sup>1</sup> have shown that: "There is little value in feeding a dry mash mixture which does not contain any high-protein feed, if liquid milk is being fed as a source of protein. . . . If the high-protein feed is omitted from the dry mash, it is of no value for increasing egg production."

Because of this work it was not deemed necessary to run a control pen receiving skim-milk and a basic mash containing no protein concentrate.

The mash fed the various pens was as follows:

TABLE 3.—COMPOSITION OF THE MASH

	Pen No. 1 Lbs.	Pen No. 2 Lbs.	Pen No. 3 Lbs.	Pen No. 4 Lbs.	Pen No. 6 Lbs.
Wheat Bran .....	40.0	40.0	40.0	40.0	40.0
Wheat Middlings ..	40.0	40.0	40.0	40.0	40.0
Corn Meal .....	10.0	10.0	10.0	10.0	10.0
Meat Scrap .....	2.3	4.7	7.3	10.0	10.0

<sup>1</sup> Martin, J. Holmes, 1925. Ky. Exp. Sta. Bulletin No. 260.

It will be noted that:

Pen 1 received grain,  $2\frac{1}{2}\%$  meat scrap mash and skim-milk ad lib.

Pen 2 received grain, 5 % meat scrap mash and skim-milk ad lib.

Pen 3 received grain,  $7\frac{1}{2}\%$  meat scrap mash and skim-milk ad lib.

Pen 4 received grain, 10 % meat scrap mash and skim-milk ad lib.

Pen 5 received grain, granulated buttermilk (no mash).

Pen 6 received grain, 10 % meat scrap mash and granulated buttermilk.

In the first four pens sour skim-milk was always available. Pen 5 received one pound of granulated buttermilk daily for each 25 hens, while Pen 6 received one-half pound of granulated buttermilk daily for each 25 hens. Fresh drinking water was kept before the hens in Pens 5 and 6.

The mash was available at all times in open hoppers. Oyster shell and grit were also kept before the flock.

*Results.* The 3-year average egg production was highest in Pens 1 and 3 receiving  $2\frac{1}{2}\%$  and  $7\frac{1}{2}\%$  meat scrap in the mash, respectively. Both the average winter and yearly egg production were slightly larger in Pen 3 than in Pen 1. It is interesting to note that the 3-year production of the pen receiving  $2\frac{1}{2}\%$  meat scrap was as high as that of the pen receiving 5% meat scrap in the mash. Pen 4, receiving 10% meat scrap in the mash, did not produce as many eggs in the 3-year average as the pen receiving  $2\frac{1}{2}\%$  meat scrap in the mash (Pen 1).

Pen 5, receiving grain and granulated buttermilk, produced a smaller number of eggs per hen than any of the lots receiving skim-milk and meat scrap mash. Pen 6, which received grain, granulated buttermilk and mash produced a larger average number of eggs per year than Pen 5, but did not produce as large a number of eggs as any of the pens receiving skim-milk. The first series of the trial included only a ten months record for these two pens, as they were discontinued because of a raid by a fox.

**TABLE 4.—AVERAGE WINTER\* EGG PRODUCTION PER HEN.**  
Barred Plymouth Rocks.

Basal Feed	Skim-milk and Grain				Granulated Buttermilk and Grain	
Pen Number ..	1	2	3	4	5	6
Supplement	Mash	Mash	Mash	Mash	No Mash	Mash
Percentage of Meat Scrap in the Mash .....	2½	5	7½	10	....	10
1925-26 .....	34.6	37.1	37.7	37.5	40.2	35.6
1926-27 .....	47.7	56.0	54.6	47.9	39.4	43.9
1927-28 .....	59.6	52.1	56.3	47.9	35.0	44.7
Ave. of 3 Trials	47.3	48.4	49.5	44.4	38.2	41.4

\*November 1 to February 28, inclusive (4 months).

The winter egg production of all pens is proportional in most cases to the yearly production. In average production, the pen receiving 7½% meat scrap in the mash was highest, but all

**TABLE 5.—AVERAGE YEARLY EGG PRODUCTION PER HEN**  
Barred Plymouth Rocks

Basal Feed	Skim-milk and Grain				Granulated Buttermilk and Grain	
Pen Number ..	1	2	3	4	5	6
Supplement	Mash	Mash	Mash	Mash	No Mash	Mash
Percentage of Meat Scrap in Mash .....	2½	5	7½	10	....	10
1925-26 .....	150.3	152.4	165.0	156.1	146.2*	122.2*
1926-27 .....	175.8	172.8	177.7	157.3	154.1	148.5
1927-28 .....	183.9	162.0	179.3	174.7	138.2	166.0
Ave. of Trials	170.0	162.4	174.0	162.7	164.2†	157.3†

\*Ten months.

†Two years average, 1926-27 and 1927-28.

lots receiving skim-milk in addition to grain and mash gave higher production than the two pens receiving granulated buttermilk.

The same conclusions may be drawn from the one year trial with White Leghorn pullets. As shown in Table 6, the pen receiving 7½% meat scrap mash exceeded all other pens in production for the year. This was true of the winter production as well. It will be noted when Pen 6 is compared with Pen 4 that skim-milk proved to be a more efficient supplement than granulated buttermilk. The production of Pen 5 was less than that of any other pen.

**TABLE 6.—EGG PRODUCTION PER HEN, WHITE LEGHORNS**

Basal Feed	Skim-milk and Grain				Granulated Buttermilk and Grain	
Pen Number ..	1	2	3	4	5	6
Supplement	Mash	Mash	Mash	Mash	No Mash	Mash
Percentage of Meat Scrap in Mash .....	2½	5	7½	10	....	10
Winter .....	48.2	47.6	49.9	46.2	24.9	35.6
Year .....	149.2	167.0	173.4	151.1	114.5	155.3

The pens receiving skim-milk in the ration consumed practically the same total amounts of feed (including milk solids). Pen 4, receiving 10% meat scrap mash, consumed the largest amount of skim-milk and of corn. The total consumption of feed, including the milk solids, was 2.7 pounds more than that of the 5% meat scrap pen. Altho Pen 5 consumed more grain than any other pen, the total feed consumption was lowest in this pen. The consumption was 2.2 pounds less than that of Pen 6, which received mash and grain, in addition to the granulated buttermilk.

TABLE 7.—FEED CONSUMPTION PER HEN, POUNDS

1925-26				1926-27			1927-28			Average			
Pen	Grain	Mash	Skim milk or Dried Buttermilk	Grain	Mash	Skim milk or Dried Buttermilk	Grain	Mash	Skim milk or Dried Buttermilk	Grain	Mash	Skim milk or Dried Buttermilk	Total Feed With Milk Solids†
1	58.7	13.7	110.8	62.1	10.0	127.3	48.4	17.8	158.1	56.4	13.8	132.1	83.3
2	60.6	13.4	125.5	62.8	11.4	127.3	45.3	15.6	146.3	56.2	13.5	133.0	82.9
3	57.7	13.0	108.5	64.4	11.3	133.9	48.6	17.8	163.3	56.9	14.0	135.8	84.3
4	66.2	12.8	139.6	62.0	10.6	128.7	47.8	15.1	159.5	58.7	12.8	142.6	85.6
5	*67.8	none	*13.3	71.1	none	15.4	58.9	none	14.3	†65.0	none	†14.8	79.8
6	*61.4	*15.5	*7.2	67.5	10.9	8.4	53.5	16.9	6.9	†60.5	†13.9	†7.6	82.0

\*Calculated for the year on the basis of consumption for ten months.

†Average of two years trial.

‡Milk solids in skim-milk, taken from "Feeds and Feeding," Henry and Morrison.

The nutritive ratios of the feed consumed by the lots receiving skim-milk varied only to a small degree showing a slight decrease as the amount of meat scrap in the mash increased. The ratios of Pens 5 and 6 were almost identical and somewhat wider than those of the pens receiving skim-milk.

TABLE 8.—NUTRITIVE RATIOS OF FEED CONSUMED

Pen	Meat Scrap in Mash—Percent	1925-26	1926-27	1927-28	Average
1	2½	1:5.48	1:5.43	1:5.14	1:5.35
2	5	1:5.29	1:5.36	1:5.46	1:5.37
3	7½	1:5.36	1:5.28	1:4.98	1:5.21
4	10	1:5.17	1:5.24	1:4.37	1:4.93
5	no mash	1:6.26	1:6.08	1:5.85	1:6.06
6	10	1:6.13	1:6.37	1:5.88	1:6.13

From the standpoint of the maintenance of weight all the rations were satisfactory. In all trials the average weight of the hens at the end was more than at the beginning of the trial. It is interesting that the hens in Pens 5 and 6, in nearly every

instance, were lighter at the end of the trial than the hens of the other lots. This may be explained by the fact that the feed consumed per hen, in these two pens was less than in the other four pens.

**TABLE 9.—AVERAGE WEIGHT OF HENS, POUNDS**  
Barred Plymouth Rocks

	1925-26			1926-27			1927-28		
Pen	Start	End	Ave. Gain	Start	End	Ave. Gain	Start	End	Ave. Gain
1	4.6	5.9	1.3	4.9	5.8	0.9	3.9	4.9	1.0
2	4.6	6.1	1.5	5.0	6.0	1.0	4.0	5.2	1.2
3	4.7	5.9	1.2	4.8	5.6	0.8	4.2	4.9	0.7
4	4.6	5.5	0.9	4.8	6.1	1.3	4.4	5.5	1.1
5	4.6	5.1	0.5	4.7	5.5	0.8	4.3	5.9	1.6
6	4.7	5.1	0.4	4.9	5.6	0.7	4.0	4.7	0.7

The weights of the White Leghorn pullets followed the same general trend as those of the Barred Rocks. However, at the end of the trial, Pens 5 and 6 were heavier than any of the other lots.

**TABLE 10.—AVERAGE WEIGHT OF HENS, POUNDS**  
White Leghorns 1927-28

Pen	Start	End	Average Gain
1	2.9	3.4	0.5
2	2.7	3.3	0.6
3	2.9	3.4	0.5
4	2.8	3.4	0.6
5	2.7	3.6	0.9
6	2.9	3.6	0.7

A comparison of the costs and returns shows that the 7½% meat scrap lot produced the largest number of eggs, at the least cost per dozen, and yielded the largest net returns over feed

costs. All pens receiving skim-milk produced eggs at a feed cost per dozen of 15.3 cents or less and yielded a good return on the investment in feed. (See Figure 1.)

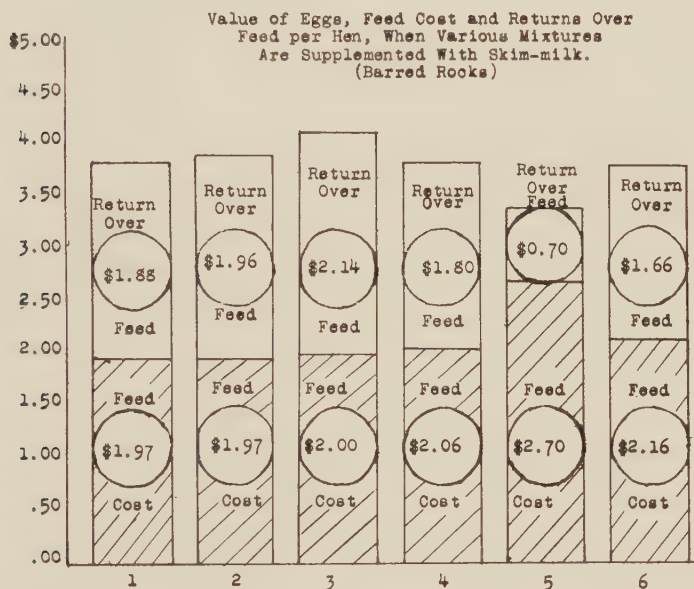


Fig. 1 Varying Amounts of Meat Scrap for Supplementing-milk

Pen 1	Grain, 2½% Meat Scrap Mash and Skim-milk
Pen 2	Grain, 5% Meat Scrap Mash and Skim-milk
Pen 3	Grain, 7½% Meat Scrap Mash and Skim-milk
Pen 4	Grain, 10% Meat Scrap Mash and Skim-milk
Pen 5	Grain, Granulated Buttermilk (no mash)
Pen 6	Grain, 10% Meat Scrap Mash and Granulated Buttermilk.

Due to the cost of the granulated buttermilk and the low egg production Pen 5, which received no mash supplement, yielded the least profit per hen. Pen 6, receiving granulated buttermilk plus grain and a 10% meat scrap mash, produced eggs at a cost of 1.1 cents more per dozen than the highest pen which received skim-milk.

TABLE 11.—COST OF FEED IN RELATION TO RETURNS—  
AVERAGE OF ALL TRIALS

Basal Feed	Skim-milk and Grain				Granulated Buttermilk and Grain	
Supplement	mash	mash	mash	mash	no mash	mash
Percentage of Meat Scrap in Mash .....	2½	5	7½	10	0	10
Pen. Number ..	1	2	3	4	5	6
Eggs produced per hen, dozen	13.36	13.47	14.44	13.47	11.98*	13.15*
Value of eggs per hen, dollars .....	3.85	3.93	4.14	3.86	3.40	3.82
Cost of feed per hen, dollars .....	1.97	1.97	2.00	2.06	2.70	2.16
Return per hen, over cost of feed, dollars .....	1.88	1.96	2.14	1.80	0.70	1.66
Cost of feed per dozen eggs, cents ....	14.7	14.6	13.8	15.3	22.5	16.4

\*Average of two years production.

## SUMMARY

1. When Barred Plymouth Rock pullets were fed a shelled-corn-skim-milk ration, supplemented with a mash containing meat scrap, the average production for three years was as follows: 2½% meat scrap—170 eggs; 5%—162.4 eggs; 7½%—174 eggs; and 10%—162.7 eggs. The winter averages were: 2½% meat scrap—47.3 eggs; 5%—48.4 eggs; 7½%—49.5 eggs; and 10%—44.4 eggs.

2. When White Leghorn pullets were fed a shelled-corn-skim-milk ration, supplemented with a mash containing meat scrap, the production for one year was as follows: 2½% meat scrap—149.2 eggs; 5%—167.0 eggs; 7½%—173.4 eggs; and 10%—151.1 eggs. The winter averages were: 2½% meat scrap—48.2 eggs; 5%—47.6 eggs; 7½%—49.9 eggs; and 10%—46.2 eggs.

3. When the amount of grain fed was kept fairly constant and the mash was kept before the birds at all times, there was no significant difference in the mash consumption of the various pens. There was also no significant difference in the amount of milk consumed by the various pens.

4. The average feed consumption over a three-year period, including milk solids, was as follows:  $2\frac{1}{2}\%$  meat scrap pen—83.3 pounds; 5%—82.9 pounds;  $7\frac{1}{2}\%$ —84.3 pounds; and 10%—85.6 pounds.

5. When Barred Plymouth Rock pullets were fed a shelled-corn-granulated buttermilk ration the average winter production for three years was 38.2 eggs; the yearly production was 146.1 eggs, while the production for the pen receiving 10% meat scrap mash in addition to the above ration was 41.4 eggs for the winter and 157.2 eggs for the year.

## Part II.

### A COMPARISON OF A DULL-GRAY GROUND LIMESTONE AND A SHINY WHITE LIMESTONE AS SOURCES OF SHELL FORMING MATERIAL\*

This experiment was run to compare the egg production of laying hens fed a common dull-gray ground limestone and a shiny white limestone as a source of shell forming material



Figure 2. The Poultry Plant at the Robinson Sub-station, Quicksand, Kentucky.

This work was conducted at the Robinson Experiment Substation, Quicksand, Kentucky. (The poultry plant is shown in Figure 2.) The dates of the tests were as follows:

Series 1. November 1st, 1925 to September 30th, 1926.

Series 2. November 1st, 1926 to October 31st, 1927.

Series 3. November 1st, 1927 to October 31st, 1928.

*Stock.* For Series 1 and 2, 25 Rhode Island Red pullets were used in each pen. For Series 3, 28 Barred Plymouth Rock pullets were used in each pen. These birds were raised on the Robinson Experiment Station farm.

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\*Roger W. Jones, Supt. of Robinson Substation, supervised the pens involved in this experiment.

*Rations.* The grain mixture for both pens consisted of 70 percent yellow corn and 30 percent oats. This was fed morning and evening in the straw litter. The mash mixture consisted of:

Wheat Bran .....	20 lbs.
Middlings .....	50 lbs.
Corn Feed Meal .....	50 lbs.
Meat Meal .....	19 lbs.
Soybean Meal .....	30 lbs.
Corn Gluten Feed .....	30 lbs.
Phosphatic Limestone .....	7 lbs.
Sulfur .....	1 lb.
Salt .....	2 lbs.

The mash was kept before the birds at all times. Neither pen received any gravel or hard grit other than that picked up in the yards. Water was available at all times. It is well to note that previous work at this Station<sup>2</sup> has shown that "calcium in rock phosphate can be utilized by the hen for the growth of bones but not in the formation of egg shell."

*Results.* On the basis of winter egg production, Pen 1, receiving a white, shiny limestone, exceeded Pen 2, receiving a dull-gray ground limestone in 1925-26. For the two following winter production periods, the lot receiving the dull-gray ground limestone exceeded the lot receiving the white, shiny limestone. The lot receiving the white limestone was appreciably higher in yearly production for the first two seasons, but the third season, the production of the two lots was practically the same.

TABLE 12.—EGG PRODUCTION PER HEN

Pen	1925-1926		1926-1927		1927-1928	
	Winter	Year	Winter	Year*	Winter	Year
1	38.8	134.3	33.5	166.6	34.9	142.7
2	24.6	109.7	38.2	149.8	42.2	141.3

\*Eleven months average.

Pen 1—White shiny limestone

Pen 2—Dull-gray limestone

<sup>2</sup> Ky. Agr. Experiment Station, Bulletin No. 250. October, 1923.

As shown in Table 13, the feed consumption for each pen was practically the same. The mineral addition was not weighed the first year, but during the two following years, the mineral consumption was practically the same for both lots.

TABLE 13.—FEED CONSUMPTION PER BIRD, POUNDS

Pen	1925-26*			1926-27			1927-28			Average†		
	Grain	Mash	Mineral	Grain	Mash	Mineral	Grain	Mash	Mineral	Grain	Mash	Mineral
1	52.9	42.7	ad lib.	51.6	43.5	3.4	51.4	32.5	4.1	51.5	37.5	3.7
2	56.7	42.8	ad lib.	51.6	45.0	3.3	52.0	34.1	4.5	51.8	39.5	3.9

\*Eleven months average.

†Two years average.

It may be inferred from this trial that it is possible to depend entirely on the usual type of ground limestone as the source of calcium for egg shell formation. The white, shiny limestone, altho somewhat more attractive to the fowls than the average type of limestone, is not greatly to be preferred. Since there is very little difference in the chemical makeup of the two materials, the chief difficulty to be encountered would be that of getting the fowls to consume enough of the darker colored limestone which is not so attractive.

#### SUMMARY

1. The white, shiny limestone proved more attractive to the birds than the dull-gray limestone.
2. Both the white, shiny limestone and the dull-gray limestone proved to be adequate sources of calcium for egg shell formation.
3. Birds may be induced to consume an adequate supply of the dull-gray ground limestone if it is kept constantly before them in open hoppers.

### Part III.

#### ALL-MASH VERSUS GRAIN AND MASH FOR LAYING HENS\*

This experiment was started October 1st, 1927, to compare all-mash and grain and mash for laying hens. A study was made of the production in relation to the gain or loss in weight; of fertility and hatchability; of mortality; of the relation of minimum temperature and egg production; and of costs and profits.



Figure 3. Experiment Station Laying House. Pens A and B on the left of central feed room, Pen C and D on the right of feed room.

*Stock.* Four pens, each containing 100 pullets and five cockerels, were used in this experiment. Pens A and B contained Barred Plymouth Rocks and Pens C and D, Single Comb White Leghorns. These birds were all raised from the Experiment Station flock. Individuality and maturity were considered in dividing the pullets. At housing time, twenty pullets were selected in each pen to be weighed weekly during the first six months of the experiment.

*House.* The pullets were housed in an open front Kentucky shed roof poultry house. Each pen of 100 pullets was placed in

\*J. R. Smyth, Field Agent in Poultry, Extension Division, aided in securing these data and in summarizing the results.

a 20 ft. x 20 ft. section. The house used is shown in Figure 3, Pens A and B being located at the left of the central feed room and pens C and D at the right of the feed room. The pullets were allowed access to grass yards except on very cold or rainy days.

*Rations.* Pens A and D received an all-mash ration, while Pens B and C received mash and grain. The mash mixtures are shown in Table 14. The mash was kept before the birds in open hoppers at all times. Pens B and C received shelled yellow corn fed in the litter. The amount of corn fed, approximated the amount of mash eaten. By this method, the ingredients of each ration were kept close to the same level. One-third of the corn was fed in the morning and two-thirds in the late afternoon. Oyster shell and fresh water were available at all times.

TABLE 14.—MASH MIXTURES

Feed	Pens A and D	Pens B and C
Ground Yellow Corn.....	650 lbs.	150 lbs.
Wheat Bran .....	100 lbs.	100 lbs.
Wheat Middlings .....	100 lbs.	100 lbs.
Meat Scrap .....	75 lbs.	75 lbs.
Dried Buttermilk .....	25 lbs.	25 lbs.
Ground Limestone .....	20 lbs.	20 lbs.
Bone Meal .....	20 lbs.	20 lbs.
Salt .....	10 lbs.	10 lbs.

## EGG PRODUCTION

*Barred Plymouth Rocks.* The average winter egg production (November to February, inclusive) of Pens A and B was almost identical. As shown in Table 15, the average for Pen A which received the all-mash ration was 54.6 eggs, while the average for Pen B receiving grain and mash was 54.7 eggs. For winter egg production the two rations were of equal value. The average yearly production of Pen A was 167.4 eggs; the average production of Pen B was 174.3 eggs, a difference of 6.9 eggs in

favor of the pen receiving grain and mash. Pen A dropped in production soon after the beginning of the experiment as shown in Figure 4. This was due to the insufficient consumption of the all-mash ration at that time. The birds were unaccustomed to the all-mash method of feeding and required a short period of time to bring their consumption of feed up to that of Pen B.

TABLE 15.—EGG PRODUCTION PER HEN 1927-28

Pen	Winter	Year
<b>BARRED ROCKS</b>		
Pen A—All-Mash .....	54.6	167.4
Pen B—Mash and Grain .....	54.7	174.3
<b>WHITE LEGHORNS</b>		
Pen C—Mash and Grain .....	55.4	182.0
Pen D—All-Mash .....	59.4	182.7

The litter and also the floor of the all-mash pens were usually damp, requiring more labor to prevent insanitary conditions. This dampness was caused by two factors: first, the flocks receiving the all-mash ration did not stir the litter and allow the air to circulate thru the litter to dry it out and, second, the droppings of the birds in Pen A were more moist. This condition did not affect the health of the birds, but required more labor to keep the pens in good condition.

*White Leghorns.* The average winter egg production of Pen D receiving the all-mash ration exceeded the average production of Pen C receiving the grain and mash ration by 4 eggs. The average yearly production, however, was the same in each case, that is 182 eggs for Pen C and 182.7 eggs for Pen D. The same drop in production of the all-mash pen is seen in Figure 7. This was also the case in the Barred Rock pen receiving the all-mash ration. As noted before the pullets were not accustomed to the ration and consequently did not eat a large amount.

The litter in the pen receiving the all-mash was damper than that in the pen receiving mash and grain.

#### FEED CONSUMPTION

*Barred Plymouth Rocks.* Table 16 shows that the average feed consumption for Pens A and B was practically the same. The birds of Pen A consumed an average of 85.4 pounds including the milk solids,\* while the birds of Pen B each consumed 84.6 pounds, a difference of only 0.8 pounds. The nutritive ratio of the feed consumed by Pen A was wider than that of Pen B. This pen (Pen B) laid more eggs than the pen receiving the feed with a wider ratio (Pen A).

TABLE 16.—FEED CONSUMPTION PER HEN AND NUTRITIVE RATIOS

Pen	Grain	Mash	Skim-milk	Total Feeds With Milk Solids*	Nutritive Ra- tio of Grain and Mash Con- sumed
A	....	85.0	3.9	85.4	1:5.37
B	41.5	42.7	3.8	84.6	1:5.17
C	37.1	44.6	3.3	82.0	1:4.94
D	....	77.7	2.7	78.0	1:5.37

*White Leghorns.* Pen C receiving grain and mash consumed 4 more pounds of feed per bird than Pen D receiving all-mash. The winter egg production, however, was in favor of Pen D. The yearly production was the same in each case. The nutritive ratio was narrower in the grain and mash ration.

#### MORTALITY AND CULLING

*Barred Plymouth Rocks.* Nine hens in each pen died during the year. Eighteen hens in Pen A and thirteen hens in Pen B were culled. All hens not laying ten or more eggs in some one

\*A small amount of skim-milk was fed all pens in August, to hold up summer production.

winter month were culled at the end of the winter period (Feb. 29). Any birds showing signs of sickness or any deformity were also removed at that time.

TABLE 17.—MORTALITY AND CULLING

	Barred Rocks		White Leghorns	
	A	B	C	D
Pens .....	9	9	6	8
Number of Deaths .....	18	13	5	6
Number Culled .....				

*White Leghorns.* Six hens died in Pen C and eight in Pen D. Five were culled in Pen C and six in Pen D.

#### COMPARISON OF WEIGHT AND PERCENTAGE EGG PRODUCTION

*Barred Plymouth Rocks.* Twenty pullets from each lot were weighed at weekly intervals. From a comparison of body weight and egg production it may be concluded that there is a direct relation between a change in body weight and egg production. As shown in Figure 4, a loss in body weight was followed by a decline in egg production. The loss in body weight December 3 to 10 was followed by a decline in the production of most of the birds. A loss in weight on January 21 was also followed by a drop in production. Gains in weight were followed by a gain in production. The curves of production of the weighed birds and of the entire pen follow much the same trend thru the experiment with, however, an occasional variation, the production for the pen usually being slightly lower than for the weighed birds (See Figure 4).

Pen B showed much the same result with the exception that the weight and percentage egg production did not decrease at the start of the experiment since the birds were accustomed to the ration. It is apparent that both pens gained normally and with few exceptions maintained their body weight thruout the

experiment. The slow drop in weight toward the end of the trial may have been due to the physical strain of heavy production (See Figure 5).

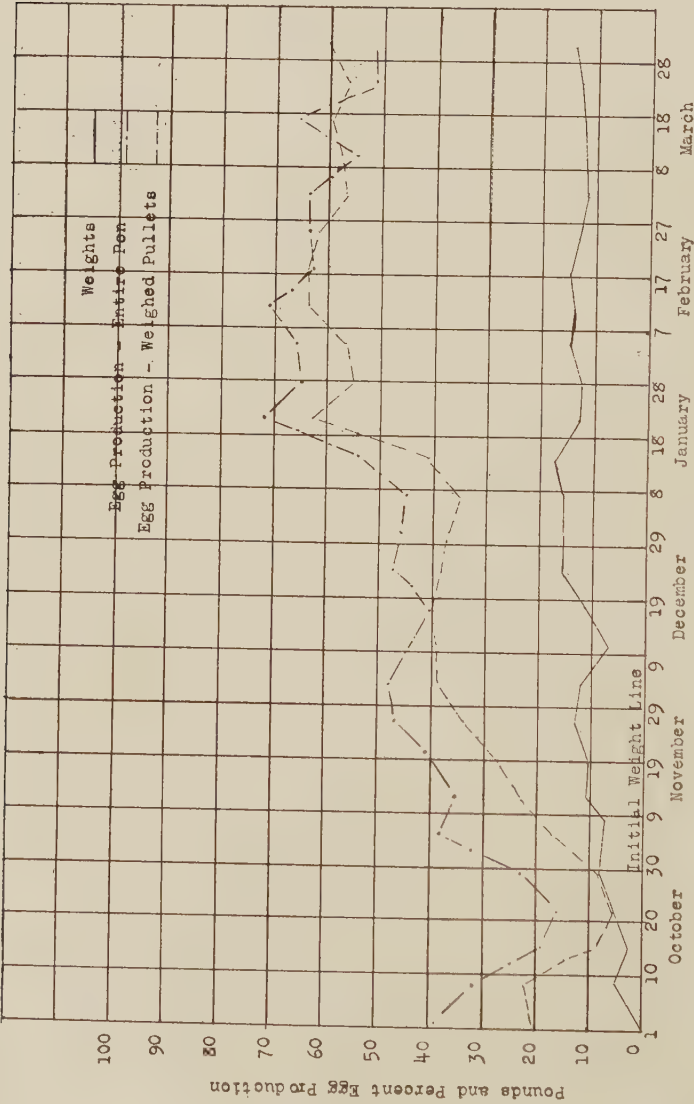


Figure 4 - A Comparison of Weight and Percentage Production of Pen A.

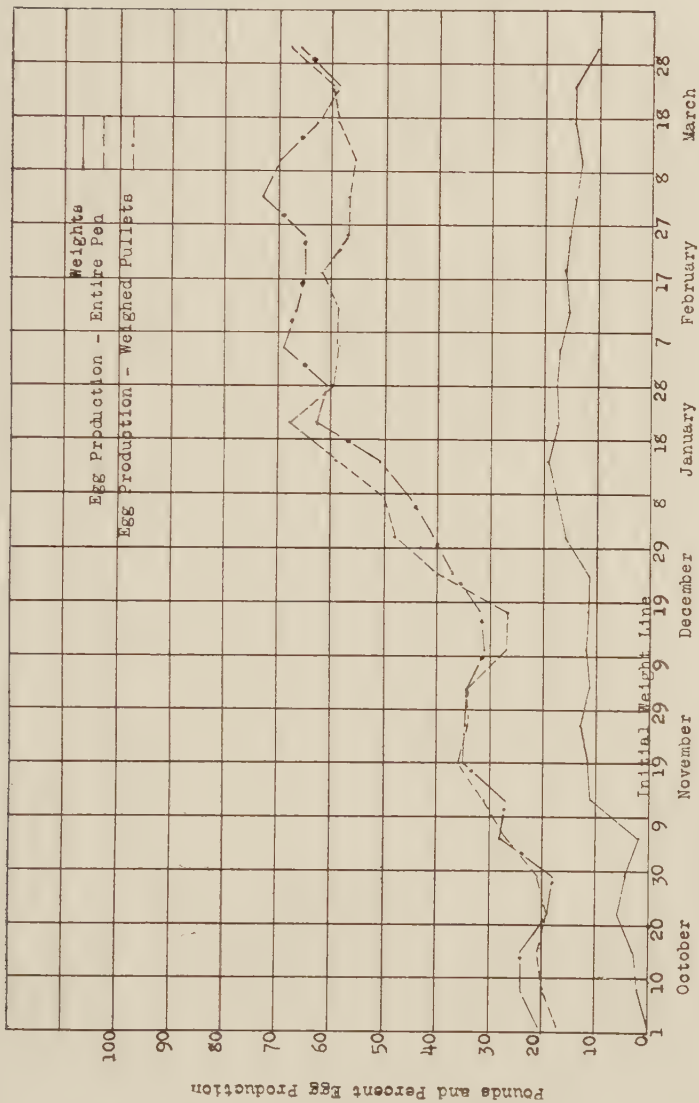


Figure 5 - A Comparison of Weight and Percentage Production of Pen B

*White Leghorns.* The same direct relation between production and body weights was noticed in Pens C and D. A loss in body weight was followed by a drop in production. A gain in

body weight was followed by a gain in production. The same effect of starting the pullets on the all-mash ration was apparent as with the Barred Rocks. The Leghorns, however, tended to

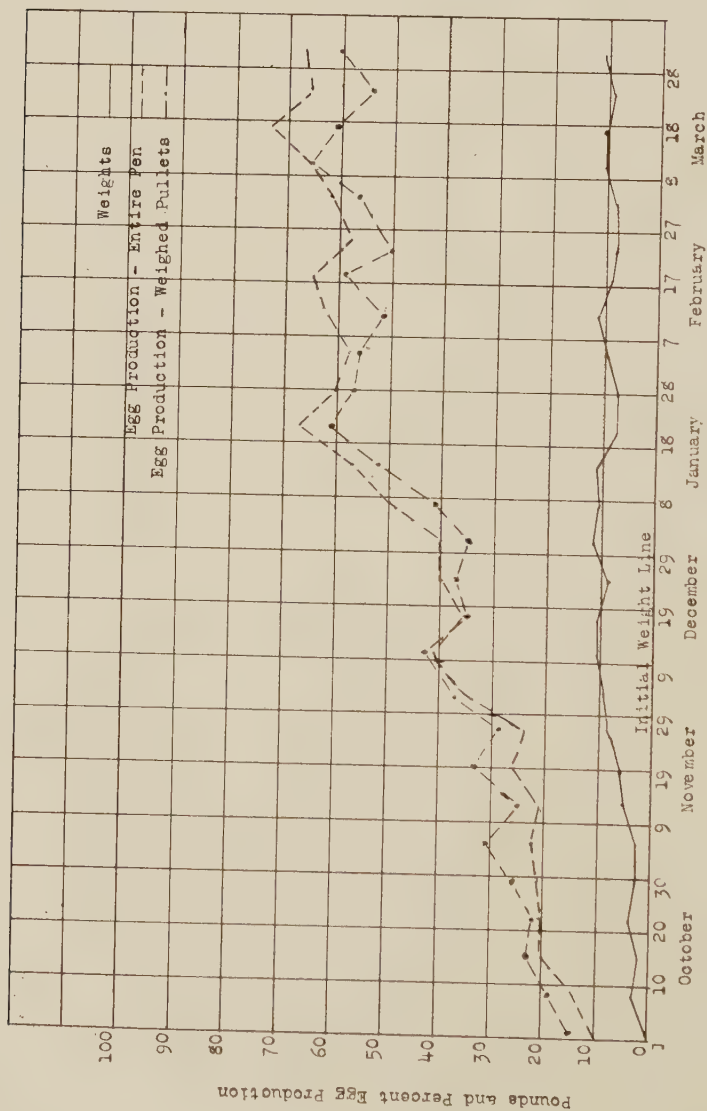


Figure 6 - A Comparison of Weight and Percentage Production of Pen C.

maintain their weight with less variation than the Rocks fed the same ration (See Figure 6).

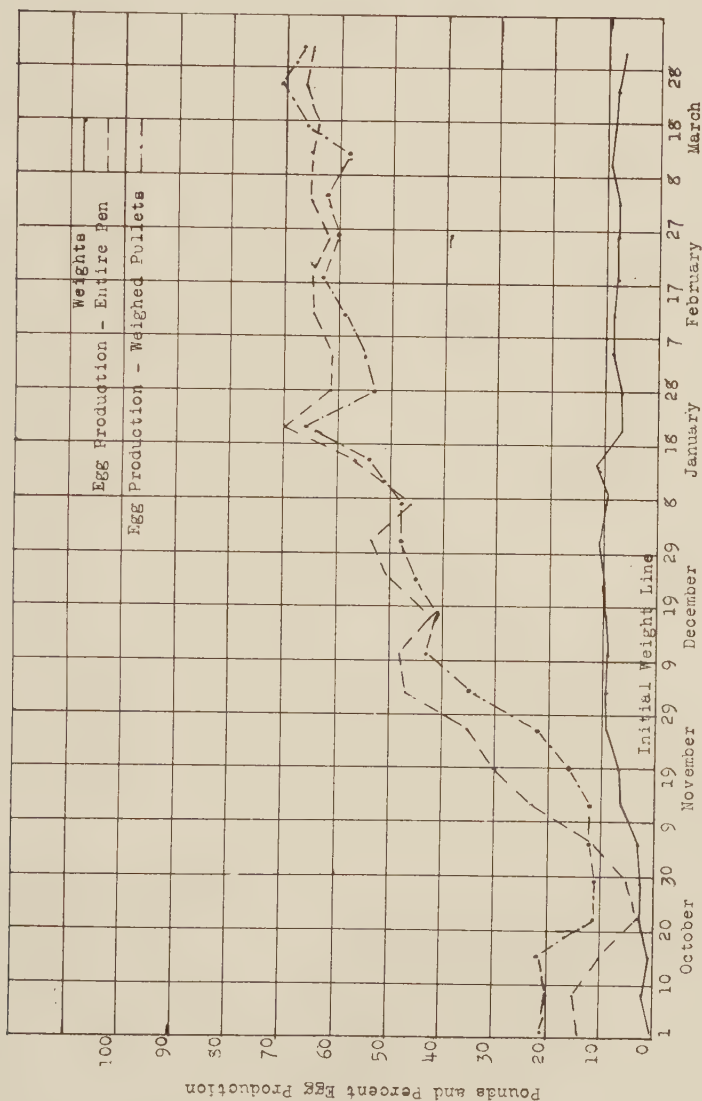


Figure 7 -- A Comparison of Weight and Percentage Production of Pen D.

Since both pens receiving all-mash declined in production when first started on the ration, it is believed advisable to raise pullets intended for all-mash rations on the same type of ration or to make the change from grain and mash before the birds commence laying (See Figure 7).

*Comparison of Minimum Temperature and Percentage Egg Production.* The temperature graphs, Figures 8 and 9, were based on the reports of the United States Weather Bureau at Lexington for the six months from October, 1927, to March, 1928, inclusive. Only minimum temperatures were used. The climate of Kentucky is subject to sudden and sharp changes in temperature during the winter months.

Reference to Figure 8 shows that in Pen A\* there was a direct relation between minimum temperature and egg production. A sudden drop in temperature was followed one or two days later by a drop in production. The series of low temperatures from November 30th to January 5th seemed to hold the production at a low level since a rise in temperature from January 5th to January 18th allowed a rise in egg production. Subsequent declines in temperature, altho causing a fall in production, never brought it to the former low level (See Fig. 8.)

Figure 9, which includes the production of the White Leghorn pen receiving grain and mash, shows the same relation between production and minimum temperature. This pen also responded to lower temperatures one or two days after the decline in temperature. Rises in temperature gave an increase in egg production (See Figure 9).

#### FERTILITY AND HATCHABILITY

*Barred Plymouth Rocks.* The effect of the two rations on fertility and hatchability of the eggs was determined by setting eggs from each pen. The eggs set from the entire pen were saved for three days, while those from the weighed pullets were saved for ten days.

There was no significant difference in the hatchability of eggs from pens A and B. The eggs from the weighed pullets in Pen B gave the lowest percentage hatch of any group. Compar-

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\*Pen A consisted of Barred Plymouth Rocks fed on an all-mash ration.

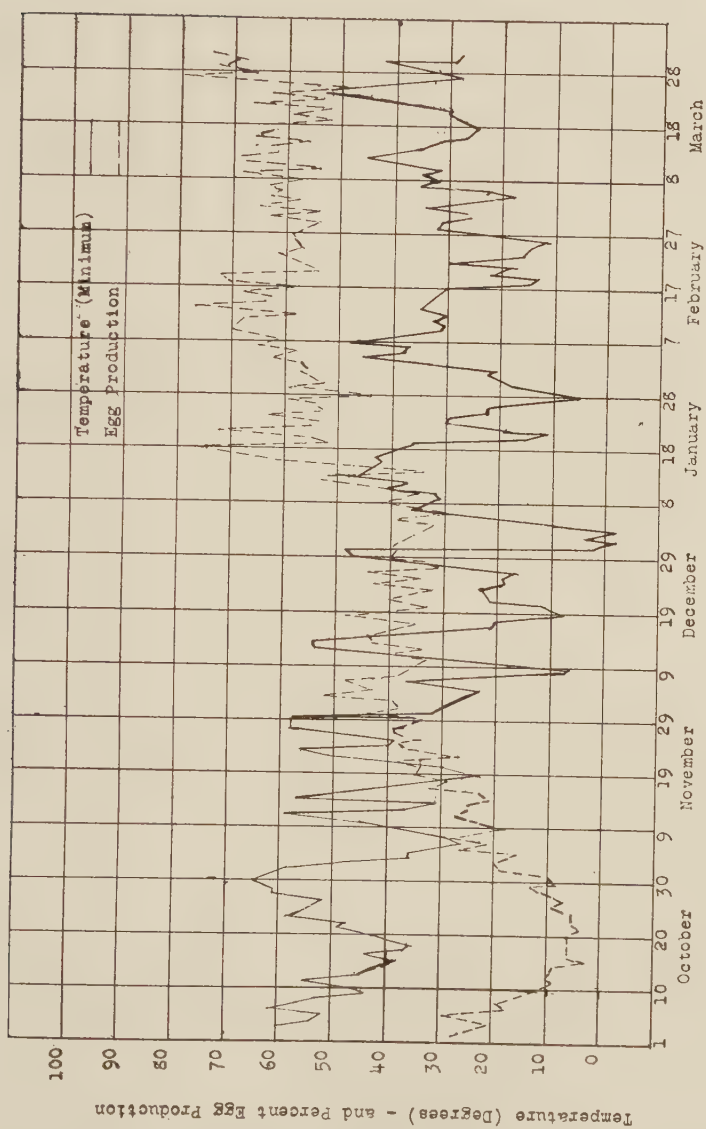


Figure 8 - A Comparison of Minimum Temperature and Percentage Egg Production - Pen A.

ing all fertile eggs from both pens, hatches of 76 percent for Pen A and 74.4 percent for Pen B were secured (See Table 18).

*White Leghorns.* High fertility and hatchability were

obtained with both the all-mash and the grain and mash rations. Pen C gave an 81 percent hatch of the fertile eggs, and Pen D a 77.5 percent hatch of the fertile eggs.

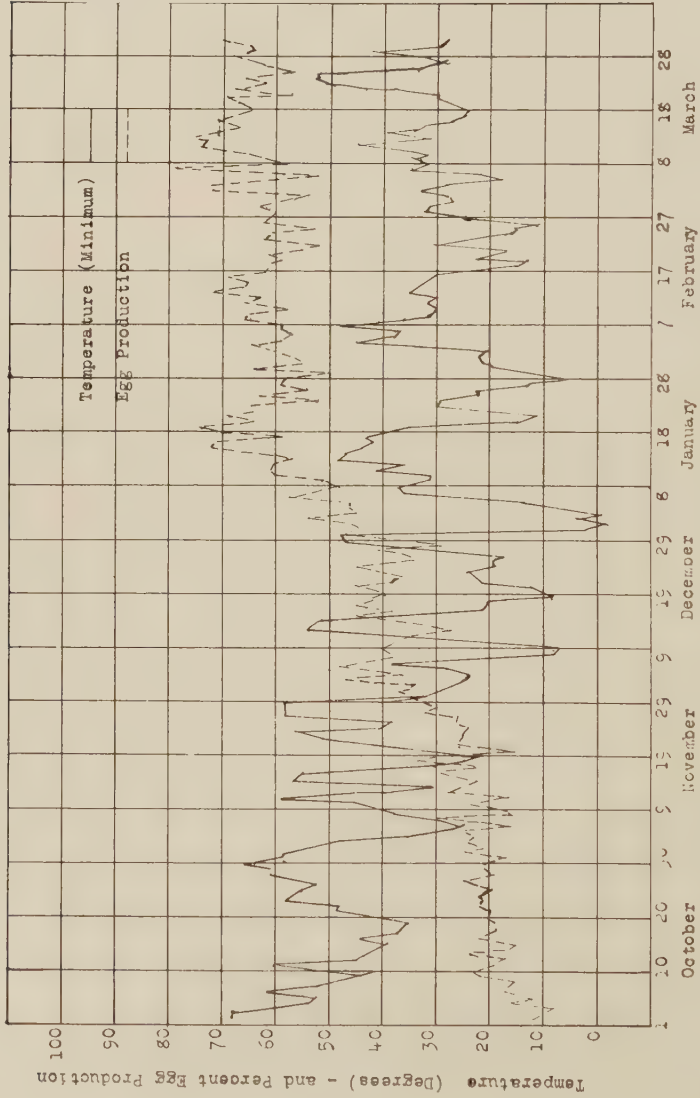


Figure 9 - A Comparison of Minimum Temperature and Percentage Egg Production - Pen A

## COSTS AND RETURNS

*Barred Plymouth Rocks.* The all-mash pen laid 13.82 dozen eggs per hen as compared with 14.26 dozen for the grain and mash pen. The cost of feed was 12.4 cents per dozen eggs for the all-mash pen and 11.8 cents for the grain and mash pen. The returns over the feed cost for the grain-and-mash pen exceeded those of the all-mash pen by 17 cents per hen.

TABLE 18.—FERTILITY AND HATCHABILITY

	Pen A		Pen B		Pen C		Pen D	
Pens	Entire Pen	Weighed Pullets	Entire Pen	Weighed Pullets	Entire Pen	Weighed Pullets	Entire Pen	Weighed Pullets
Number of Eggs Set .....	81	40	85	66	100	69	98	80
Number Infertile .....	12	9	11	11	11	10	9	0
Percent Infertile .....	14.8	22.5	12.9	16.7	11.0	14.5	9.2	0
Number Dead Germs ..	2	1	3	4	2	3	5	10
Percent Dead Germs ..	2.5	2.5	3.5	6.1	2.0	4.3	5.1	12.5
No. Strong Chicks .....	52	24	61	35	70	50	67	64
Percent of All Eggs .....	64.2	60.0	71.8	53.0	70.0	72.5	68.4	80.0
Percent of Fertile Eggs ....	75.3	77.4	82.4	63.6	78.6	84.7	75.3	80.0

*White Leghorns.* The average production per hen in the two Leghorn pens was practically the same. There was a difference in the cost of feed per dozen eggs of but .8 of a cent,

which was a difference in the returns over feed cost for each hen of 15 cents in favor of the all-mash pen.

TABLE 19.—COST OF FEED AS RELATED TO RETURNS

	Pen A All-Mash	Pen B Mash Grain	Pen C Mash Grain	Pen D All-Mash
Eggs produced per hen, doz. ....	13.95	14.52	15.17	15.22
Value of eggs per hen, dollars ....	4.07	4.21	4.41	4.45
Cost of feed per hen, dollars ....	1.72	1.69	1.68	1.57
Returns over cost of feed ....	2.35	2.52	2.73	2.88
Cost of feed per doz eggs, cents ....	12.3	11.6	11.1	10.3

#### SUMMARY

1. Barred Plymouth Rock pullets on an all-mash ration averaged 54.6 eggs for the winter and 167.4 eggs for the year. The pen receiving grain and mash averaged 54.7 eggs for the winter and 174.3 eggs for the year.

2. White Leghorn pullets on an all-mash ration averaged 59.4 eggs for the winter and 182.7 eggs for the year. The pen receiving grain and mash averaged 55.4 eggs for the winter and 182 eggs for the year.

3. Barred Plymouth Rock pullets on an all-mash ration consumed 85 pounds of mash per hen during the year, whereas those on the grain-and-mash ration consumed 84.2 pounds of grain and mash per hen.

4. White Leghorn pullets on an all-mash ration consumed 77.7 pounds of mash per hen during the year, whereas those on the grain-and-mash ration consumed 81.7 pounds of grain and mash per hen.

5. The mortality was low in all pens.

6. There was no significant difference in the mortality, health, fertility and hatchability between the different pens.

7. There was a distinct relation between maintenance of body weight and egg production. When body weight dropped, a drop in egg production soon followed in nearly every case.

8. Sudden drops in temperature in most cases were followed by declines in production.

9. The return over feed cost from the grain-and-mash pen of the Barred Rocks exceeded that from the all-mash pen by 17 cents per hen; whereas that of the Leghorn all-mash pen exceeded that of the grain-and-mash pen by 15 cents per hen.

10. Proper sanitation was more difficult in the all-mash pens because of moist droppings and wet litter.

